An Oracle White Paper
January 2011

Oracle's Sun Fire X4170 M2 and Sun Fire X4270 M2 Server Architecture

ORACLE

Introduction

Oracle introduces the new Sun Fire X4170 M2, the most versatile IT infrastructure building block server and the Sun Fire X4270 M2 server, the ideal server for clustered database and virtualized workloads.

These serves build on the excellent foundation provided by their predecessors, the Sun Fire X4170, X4270 and X4275 server and extend their capabilities in many dimensions without requiring any sacrifices to be made in ease of management or datacenter efficiency.

By adopting the latest Intel Xeon Processor 5600 Series CPU's, 50% more processing capacity has been provided[1], whilst remaining within the physical and environmental footprint of the earlier generation of systems. In order to maintain a balanced approach to the servers in keeping with their enhanced processing capabilities, their storage capabilities have been significantly enhanced with the introduction of SAS2 capable conventional Hard Disk Drives (HDD's) and Solid State Disk drives (SSD's). This combination of flexible high performance storage devices is further augmented by the introduction of a new 2 Rack Unit (2RU) server configuration, capable of holding up to twenty four 2.5" HDD's or SSD's.

The ability to choose a suitable configuration of processing capacity, memory configuration and appropriate storage capacity together with the expandability offered by the high bandwidth PCIe generation 2 I/O subsystem in a 1RU or 2RU chassis provide extreme flexibility in the applications that can be comfortably hosted on the Sun Fire X4170 M2 and X4270 M2.

These powerful systems are well suited for many common datacenter applications. The Sun Fire X4170 M2 specifically addresses IT infrastructure services and application

[1] The Intel Xeon Processor 5600 Series CPU's support up to 6 CPU Cores, compared to the previous generation Intel Xeon Processors 5500 series CPU's 4 cores.

development whereas the Sun Fire X4270 is well suited as a clustered database platform. Table 1 provides additional details on the target application areas.

TABLE 1. TARGET APPLICATION AREAS FOR SUN FIRE X4170 M2 AND X4270 M2 SERVERS

SUN FIRE X4170 M2 TARGET APPLICATIONS	SUN FIRE X4270 M2 TARGET APPLICATIONS
• **IT Infrastructure Services**, serving roles such as Administration hubs, Authentication and identity servers via Oracle Identity manager, as well as LDAP, Active Directory and associated services. Key to these services are reliability and responsiveness requirements directly contributing to customer satisfaction. • **Application Development platforms,** developers requiring standalone of even virtualized development platforms capable of reflecting real workload performance and capabilities while providing reliability and remote manageability and recoverability. •	• **Clustered Database platforms,** clustering takes advantage of high performance, reliable nodes with large memory capacity, and excellent IO bandwidth. By taking advantage of Flash storage acceleration options as well as high local storage capacity, whether requiring large disk counts or achievable disk capacity, users can provide significant application performance improvements in both responsiveness and capacity compared to earlier generations of servers.

Sun Fire X4170 M2 and X4270 M2 Servers

Designed to help customers optimize value and reduce complexity in their infrastructures, Oracle's Intel Xeon Processor 5600 Series based systems—the Sun Fire X4170 M2 and X4270 M2 servers blend cost-effective, industry-standard components with innovative technologies, this approach yields compact new 1U and 2U servers with unprecedented density, high performance, and energy efficiency.

The Sun Fire X4170 M2 and X4270 M2 servers offer:

- **Advanced levels of performance.** The Sun Fire X4170 M2 and X4270 M2 servers share a common motherboard that contains two sockets for Intel Xeon Processor 5600 Series CPU's. With the Intel Hyper-Threading (HT) Technology, these CPUs can provide 50% more compute threads as previous-generation processors[2]. They also support enhanced power management features, the QuickPath Interconnect, and Intel Turbo Boost technology, which help them deliver new levels of performance while lowering power consumption.
- **Remarkable density.** Density is the cornerstone of the Sun Fire X4170 M2 and X4270 M2 server designs. When populated in a 42-rack-unit (42U) enclosure, the 1U Sun Fire X4170 M2 server facilitates a single rack with as many as 84 processors, 756 DIMM slots, and 126 PCI Express (PCIe) 2.0 slots. In a single 2U chassis, the Sun Fire X4270 M2 server supports up to 24 TB of internal storage (based on 12 x 2GB 3.5-inch SATA disk devices), or up to 24 x 300GB SATA 2.5" disks. Providing the density needed for clustered database, consolidation, and virtualization initiatives, or as standalone administrative or development servers, these systems provide excellent flexibility for a wide variety of deployment scenarios. The result: a consistent deployment platform throughout the datacenter, conserved space, lower energy costs, and less need for costly administrative talent. Support for multiple operating systems helps streamline consolidation, simplify virtualization, and reduce server sprawl.
- **Extensive system expandability.** The ability to expand a server over time reduces the need for additional capital acquisitions and lowers application lifecycle costs. The 1U Sun Fire X4170 M2 server enables a maximum of eight internal 2.5-inch hard disk devices (HDDs), and the two variants of the 2U Sun Fire X4270 M2 server provides as many as 24 2.5-inch devices and as many as six eight-lane PCIe 2.0 slots. With an two new innovative 2U chassis enclosures that can house either 12 x 3.5-inch disk devices or 24 x 2.5" disk devices, the Sun Fire X4270 M2 server supports as many as 24 internal HDDs or as much as 24TBytes of storage capacity and as many as six PCIe 2.0 slots. Further, customers can choose to configure two additional

[2] Intel Xeon Processos 5600 series platforms offer 4 or 6 cores per socket, previous Intel Xeon Processor 5500 series platforms provide up to 4 cores.

rear panel mounted 2.5" SATA drives in 2RU platforms, in place of two PCIe slots. All three server variants are available with four onboard Gigabit Ethernet ports and can be configured with either SAS or SATA hard disk drives. The ability to support a full complement (8, 12 or 24) of low-latency SSDs in each chassis alongside conventional HDD technology allows customers to tailor their balance between conventional storage capacity and high speed Flash based devices to best accommodate the demands of their applications. This flexibility of configuration of storage mediums provides an ideal platform for optimizing storage performance-intensive applications.

- **Improved energy efficiency.** Oracle offers eco-responsible products and computing solutions to address customers' need to reduce energy consumption. In the Sun Fire X4170 M2 and X4270 M2 servers, the Intel Xeon Processor 5600 Series CPU's incorporate new technologies that decrease power consumption when processing workloads are light. When the workload is low, the new Intel Core micro-architecture adjusts power use, reducing processor frequency, limiting power to unused execution units in each core, or temporarily disabling Turbo Boost features, which together can help decrease power and cooling requirements. High-efficiency power supplies in the server chassis also lower overall power consumption. Variable-speed fans, disk carrier design, and front-to-back airflow all help cool the system and maintain appropriate processor and system ambient temperatures. This, in turn, helps minimize the energy footprint.
- **Enterprise-class high availability.** The Sun Fire X4170 M2 and X4270 M2 servers are designed with enterprise-class RAS (reliability, availability, and serviceability) features. To maximize uptime, the systems include redundant hot-swappable fans and are configurable with redundant hot-swappable power supplies. With a Sun StorageTek SAS-2 RAID host bus adapter (HBA), internal SAS or SATA disk drives can be configured for RAID 0, 1, 1E, 10, 5, 5EE, 50, 6, or 60. (When mirroring is implemented, drives are also hot-swappable.) Four integrated Gigabit Ethernet ports enhance network availability—without consuming a PCIe 2.0 slot—and can be arranged in failover configurations. Onboard system management tools encourage remote, proactive monitoring and intervention.
- **Simplified system management.** To support remote management, the Sun Fire X4170 M2 and X4270 M2 servers incorporate an independent service processor that features robust integrated lights out management (ILOM) capabilities. This built-in functionality enables administrators to monitor and manage systems remotely, facilitating corrective action and minimizing unplanned downtime. A dedicated network port is provided for ILOM or alternately "side band" management capabilities of the servers main Ethernet ports enable any one of the four onboard Ethernet ports to be configured as an alternate for system management, which can reduce the number of network switches and port connections needed, thus reducing cost to deploy remote management technologies in a datacenter.

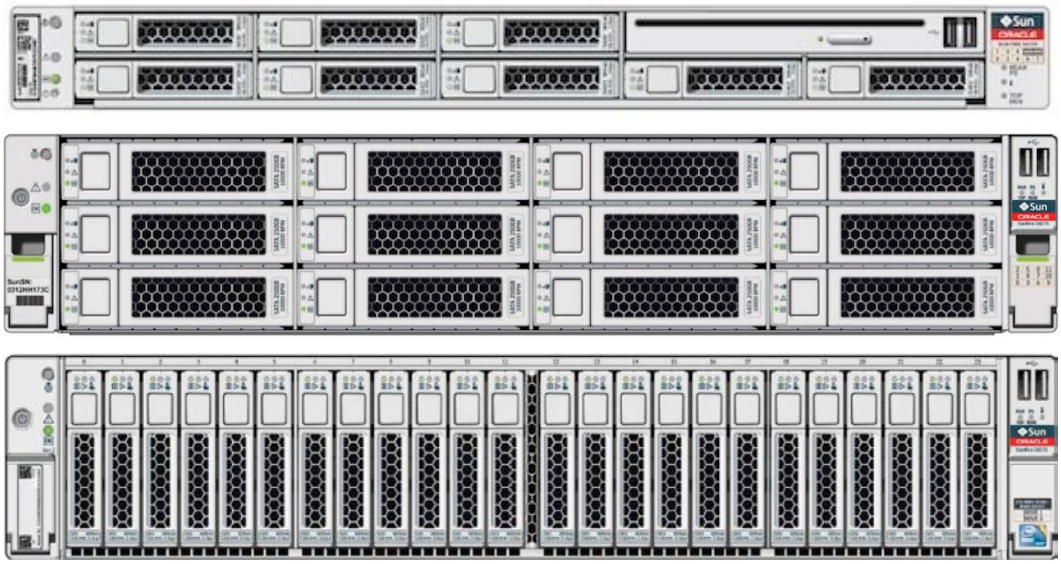

Figure 1. The Sun Fire X4170 M2, X4270 M2 – 12 Disk and X4270 M2 – 24 Disk servers are designed to scale up, scale out, and scale within, which means they can be implemented in a wide range of application architectures.

Comparing the Sun Fire X4170 M2 and X4270 M2 Servers

Integrating and optimizing open compute, storage, networking, and software technologies from across Oracle's portfolio to deliver high-performing, efficient, and scalable systems, the open network system approach has become the de facto standard for system design. Following the same design approach, the Sun Fire X4170 M2 and X4270 M2 servers leverage earlier chassis design work and further improve system effectiveness by delivering improved operational efficiencies and optimized data center value. The three models are described in Table 2.

TABLE 2. SUN FIRE X4170 M2, X4270 M2-12, AND X4270 M2-24 FEATURE COMPARISON

FEATURE	SUN FIRE X4170 M2	SUN FIRE X4270 M2, 12 DISK	SUN FIRE X4270 M2, 24 DISK
Chassis	1U	2U	2U
Number of CPU sockets	2	2	2
Supported processor type	Intel Xeon Processor 5600 Series	Intel Xeon Processor 5600 Series	Intel Xeon Processor 5600 Series
Processor system interconnect	Intel QuickPath Interconnect	Intel QuickPath Interconnect	Intel QuickPath Interconnect
Number of memory slots	18	18	18

TABLE 2. SUN FIRE X4170 M2, X4270 M2-12, AND X4270 M2-24 FEATURE COMPARISON

FEATURE	SUN FIRE X4170 M2	SUN FIRE X4270 M2, 12 DISK	SUN FIRE X4270 M2, 24 DISK
Memory capacity	Up to 144 GB (using 8 GB ECC registered dual inline memory modules [RDIMMs])	Up to 144 GB (using 8 GB ECC RDIMMs)	Up to 144 GB (using 8 GB ECC RDIMMs)
Memory type	DDR3 RDIMM	DDR3 RDIMM	DDR3 RDIMM
Internal storage: supported device size	2.5-inch	3.5-inch	2.5-inch
Internal storage: number of devices and types	Up to 8 SAS/SATA HDDs or SSD's (SAS HBA required), Up to 4 SATA HDD/SSD's (without an HBA)	Up to 12 SAS/SATA HDD/SSDs Optional Rear disk cage for 2 x 2.5" SATA drives, replacing two PCIe slots (SAS HBA required for all configs)	Up to 24 SAS/SATA HDD/SSDs Optional Rear disk cage for 2 x 2.5" SATA drives, replacing two PCIe slots (SAS HBA required for all configs)
Removable media	Optional SATA DVD/RW; internal USB port for internal boot devices	No DVD/RW option; Internal USB port for internal boot devices	No DVD/RW option; Internal USB port for internal boot devices
Number of PCIe 2.0 slots	3 total (1 x16, 2 x8)	6 total (all x8)	6 total (all x8)
Number of Gigabit Ethernet ports	4 onboard	4 onboard	4 onboard
Number of USB ports	2 front, 2 rear, 1 internal	2 front, 2 rear, 1 internal	2 front, 2 rear, 1 internal
System management	• Onboard ILOM service processor • Side-band management via onboard Gigabit Ethernet port or through 10/100 Ethernet system management port	• Onboard ILOM service processor • Side-band management via onboard Gigabit Ethernet port or through 10/100 Ethernet system management port	• Onboard ILOM service processor • Side-band management via onboard Gigabit Ethernet port or through 10/100 Ethernet system management port

TABLE 2. SUN FIRE X4170 M2, X4270 M2-12, AND X4270 M2-24 FEATURE COMPARISON

FEATURE	SUN FIRE X4170 M2	SUN FIRE X4270 M2, 12 DISK	SUN FIRE X4270 M2, 24 DISK
RAS components	• Hot-swappable and redundant power supplies, fans, disk drives • RAID 0, 1, 10, 1E, 5, 6, 50, 5EE, 60 provided via optional SAS-2 RAID HBA	• Hot-swappable and redundant power supplies, fans, disk drives • RAID 0, 1, 10, 1E, 5, 6, 50, 5EE, 60 provided via optional SAS-2 RAID HBA	• Hot-swappable and redundant power supplies, fans, disk drives • RAID 0, 1, 10, 1E, 5, 6, 50, 5EE, 60 provided via optional SAS-2 RAID HBA
OS support[3]	Oracle Solaris, Oracle Enterprise Linux, Oracle VM, Red Hat Enterprise Linux , SuSE Linux Enterprise Server, Microsoft Windows Server, VMware ESX/ESXi	Oracle Solaris, Oracle Enterprise Linux, Red Hat Enterprise Linux, SuSE Linux Enterprise Server, Microsoft Windows Server, VMware ESX/ESXi	Oracle Solaris, Oracle Enterprise Linux, Oracle VM, Red Hat Enterprise Linux , SuSE Linux Enterprise Server, Microsoft Windows Server, VMware ESX/ESXi

As Table 2 shows, the systems share numerous features, including:

- One or two Intel Xeon Processor 5600 Series processors
- Integrated memory controller supporting up to 1,333-megatransfer-per-second (MT/sec) registered DDR3 memory modules (memory is organized in three channels per processor)
- Multiple point-to-point Intel QuickPath Technology-based interconnects
- Turbo Boost mode and HT capabilities
- Intel 5520 chipset and Intel 82801JR I/O Controller Hub (ICH10R)
- Large-capacity internal storage, including support for SSDs and HDDs
- PCIe 2.0 expandability
- Built-in quad Gigabit Ethernet support
- An onboard ILOM service processor for system management
- Enterprise-class RAS features, including redundant, hot-swappable power supplies, fans, and drives
- Support for multiple operating systems

[3] Please refer to http://www.oracle.com for the most up to date information on supported versions of Operating Systems for each platform.

A Choice of Operating Systems

To optimize flexibility and investment protection, the Sun Fire X4170 M2 and X4270 M2 servers support a choice of operating systems[3], including

- Oracle Solaris
- Oracle Enterprise Linux
- Oracle VM
- Red Hat Enterprise Linux
- SuSE Linux Enterprise Server
- Microsoft Windows Server
- VMware ESX and ESXi

The Intel Processor 5600 Series Advantage

Oracle has worked closely with Intel Corporation to bring to market a broad server family based on the latest Intel Xeon processor technology. In the Sun Fire X4170 M2 and X4270 M2 servers, system engineering expertise combines with processor design proficiency to emphasize performance, quality, reliability, and eco-responsibility. Engineers have optimized system performance under Oracle Solaris as well as under other operating environments.

The Sun Fire X4170 and X4270 M2 servers incorporate Intel Xeon Processor 5600 Series processors, which include the revolutionary QuickPath interconnect and the Intel Xeon micro architecture. Each server incorporates a common motherboard populated with one or two processors, enabling the system to deliver short response times and high throughput for performance hungry applications. Compatible with a legacy of IA-32 software, these 64-bit processors support a large volume of existing 32-bit applications as well as emerging 64-bit applications.

Intel Core Micro architecture

With this latest introduction, Intel transitioned to a 32 nm manufacturing process that enabled smaller transistors, enabling this newest processor generation to pack up to six processor cores and cache into a die that consumes the same space and power as the previous generation.

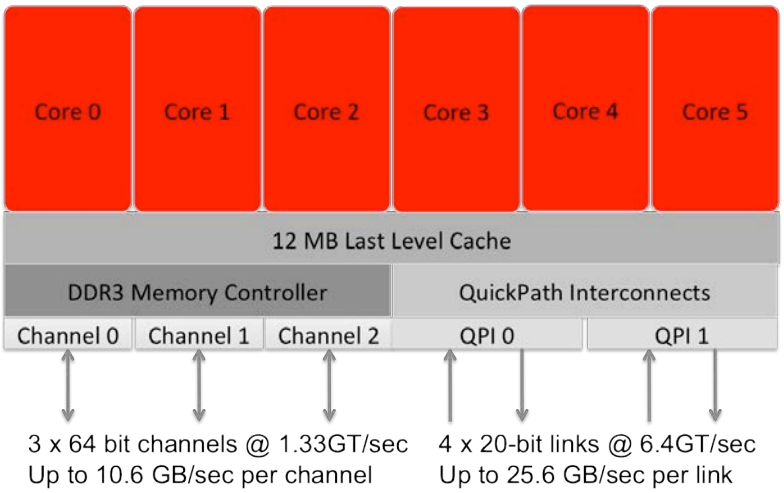

Figure 2. The micro architecture employed by the Intel Xeon Processor 5600 Series CPU offers significant innovations over previous designs.

The New Intel Core micro architecture is extremely modular, enabling a range of implementations to meet a variety of application needs and price points. The Sun Fire X4170 M2 and X4270 M2 servers are available with processors from the "Advanced" , "Standard" and "Low Power" processor classes. Processors in these servers feature four or six cores, 12 MB of shared L3 cache, and Turbo Boost and HT capabilities.

For more information on the latest Intel Xeon Processor 5600 Series CPUs, please visit Intel's website at http://www.intel.com.

Intel Xeon Processor 5500 Platform

The Sun Fire X4170 M2 and X4270 M2 servers share the same motherboard and thus the same Intel Xeon 5500 Series chipset platform. The processors interface to each other and to an Intel 5520 IOH over QuickPath Technology interconnects. The IOH interfaces with an Intel 82801JR I/O Controller Hub (ICH10R), enabling expandability and high I/O throughput. Each Intel Xeon Series platform is designed to match processor performance with memory capacity, I/O expandability, and interconnect bandwidth.

Sun Fire X4170 M2 and X4270 M2 Server Architectures

The Sun Fire X4170 M2 and X4270 M2 servers are designed to provide best-in-class performance along with unprecedented expandability and low power consumption. This section details physical and architectural aspects of the systems, highlighting similarities and differences among the server designs.

The three server models share a common motherboard architecture: one or two Intel Xeon Processor 5600 Series processors connect to an Intel 5520 IOH over multiple Intel QuickPath

Technology interconnects. The IOH provides PCI 2.0 expandability and interfaces with an Intel 82801JR I/O Controller Hub (ICH10R). Details of the individual servers are provided in the following section of this document.

Sun Fire X4170 M2 System-Level Architecture

To gain an understanding of the architecture of the Sun Fire X4170 M2, see the following system-level block diagrams (Figure 3 and Figure 4).

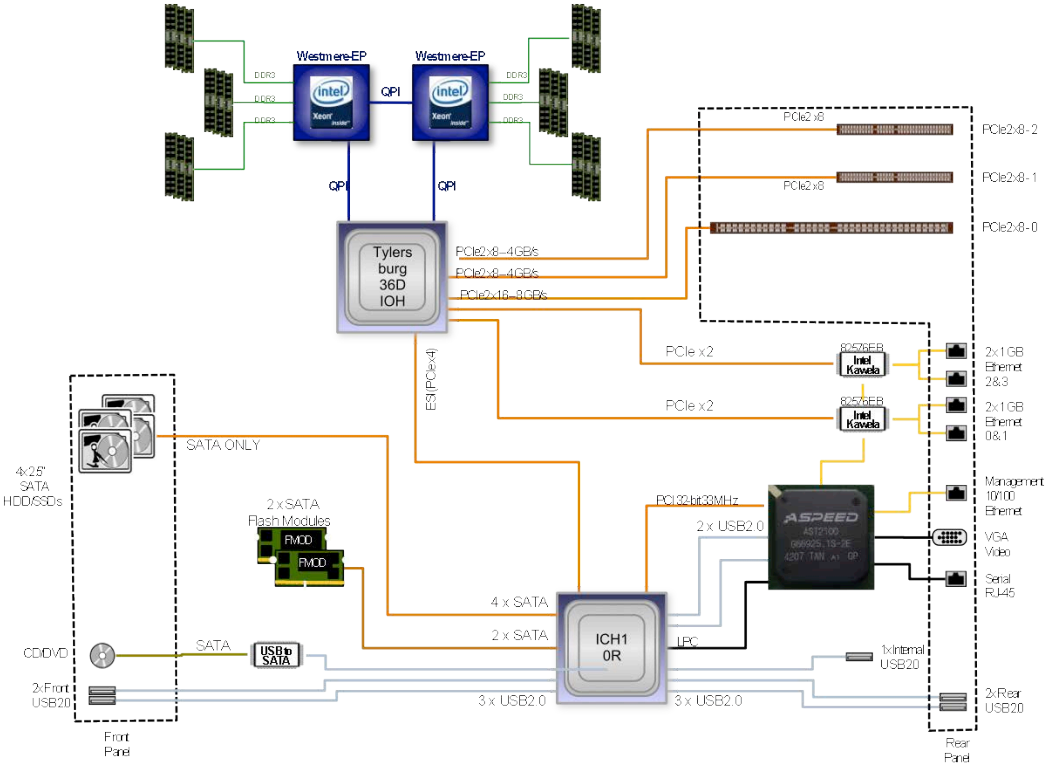

Figure 3. This block diagram depicts a Sun Fire X4170 M2 server using an internal controller to connect SATA devices.

Figure 3 shows a direct connection for as many as four SATA HDDs or SATA SSDs from the ICH10R, which features an integrated SATA-II disk controller. Figure 4 depicts a configuration with a SAS HBA card that supports as many as eight internal SAS or SATA HDDs or SATA SSDs. Note that RAID configurations are supported only via a PCIe SAS HBA card, as shown in Figure 4.

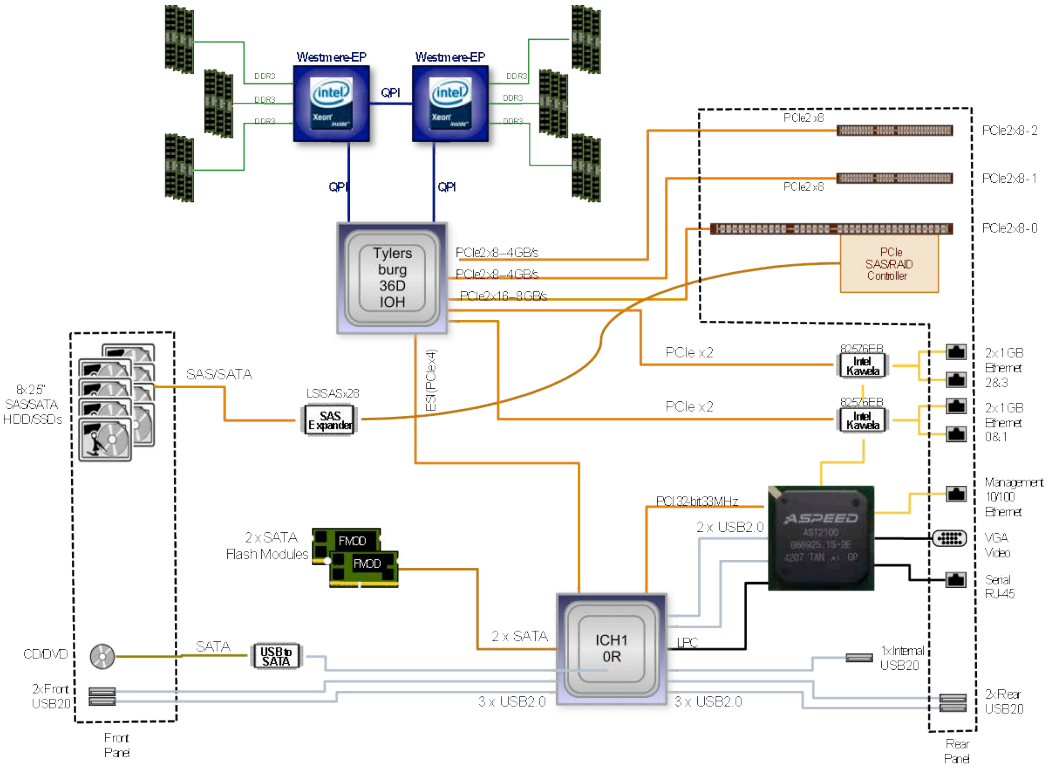

Figure 4. This block diagram depicts the Sun Fire X4170 M2 server with a SAS HBA.

Sun Fire X4170 M2 Server Overview

The Sun Fire X4170 M2 server includes the following major components:

- One or two Intel Xeon Processor 5600 Series processors
- Up to 144 GB of memory (using 8 GB registered dual inline memory modules [RDIMMs]) populated in 18 registered RDIMM slots—4 GB or 8 GB RDIMMs are supported
- Four onboard 10/100/1,000 Mb/sec Ethernet ports
- Three low-profile PCIe 2.0 slots (one 16-lane slot and two 8-lane slots)
- As many as eight internal 2.5-inch SAS/SATA HDDs or SATA SSDs (with a SAS HBA) or four 2.5-inch SATA HDDs or SSDs (without a SAS HBA card)
- Five USB 2.0 ports
- An onboard ILOM service processor
- One or two hot-swappable, high-efficiency power supply units (PSUs) for N+1 redundancy
- Seven hot-swappable, variable-speed fan modules (for N+1 redundancy), each containing two contra-rotating, low vibration fans operating under environmental monitoring

Sun Fire X4170 M2 Server Enclosure

The Sun Fire X4170 M2 server enclosure is designed to occupy 1U in a standard 19-inch rack. Table 3 provides system dimensions and weight.

TABLE 3. SUN FIRE X4170 M2 SERVER DIMENSIONS AND WEIGHT

DIMENSION	UNITED STATES	INTERNATIONAL
Height	1.71 in. (1 RU)	43.43 mm
Width	16.75 in.	425.5 mm
Depth	27.0 in.	685.8 mm
Weight	36 lb	16.36 kg maximum

Sun Fire X4170 M2 Server Front and Rear Perspectives

For views of the Sun Fire X4170 M2 server's front and rear panels, see Figure 5.

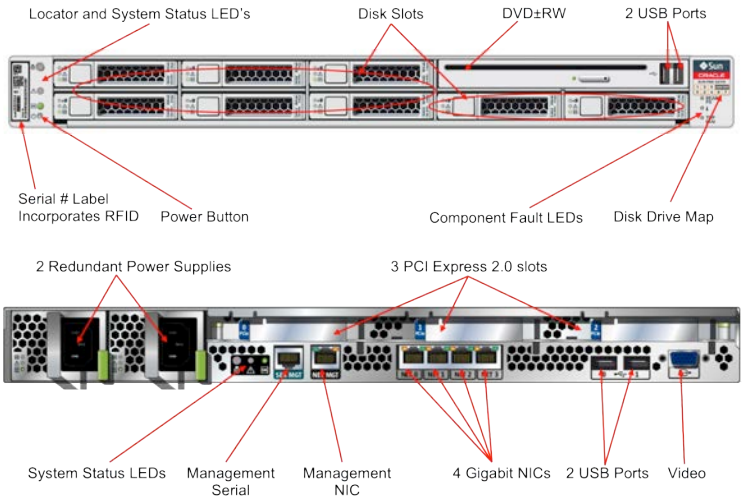

Figure 5. These views of the Sun Fire X4170 M2 server's front and rear and rear panels spotlight the server's external features and connections.

The external features and connections include

- Front and rear status indicator lights, which report "locator" (white), "service required" (amber), and "activity status" (green) for the system and components
- As many as eight 2.5-inch SAS/SATA HDDs or SATA SSDs (using a SAS HBA) or four 2.5-inch SATA HDDs or SSDs (when using the onboard SATA controller), with all HDD and SSD devices inserted through the front panel
- One slim-line, slot-accessible SATA DVD-RW, accessible through the front panel

- Five USB ports: two on the front panel, two on the rear panel, and one internal (for attaching internal boot devices)
- One or two power supply units (for N+1 redundancy) with integrated fans, with each power supply having a single, independent AC plug on the rear panel
- Rear power-supply indicator lights, showing the status of each hot-swappable power supply
- Four 10/100/1000BASE-T autosensing Ethernet ports, accessible on the rear panel
- Three PCIe 2.0 slots, in which low-profile cards can be installed from the rear panel
- Two management ports on the rear panel (one 10/100BASE-T Ethernet port, one RJ45 serial port) for default connections to the service processor, with any one of the four onboard Ethernet ports also being configurable as a system management port
- VGA video port with an analog HD-15 VGA connector on the rear panel

Sun Fire X4270 M2-12 Disk System-Level Architecture

Figure 6 is a system-level block diagram of the Sun Fire X4270 M2 12 disk server. A PCIe SAS-2 HBA card is used to support internal 3.5-inch SAS or SATA storage devices and connects to the SAS expander daughter card mounted below the disk backplane. The SAS expander does not interface to the ICH10R onboard disk controller. In the 2RU platforms, the onboard ICH10R SATA-II controller is only used to provide direct SATA-II connection to the rear mounted SATA disk cage, if installed. Sun Fire X4270 M2 servers with internal drives require a SAS-2 HBA for all front disk drive slots, regardless of drive type installed in the disk chassis.

The Sun Fire X4270 M2 -12 server supports as many as 12 internal SAS/SATA HDDs or SATA SSDs, all in a 3.5-inch form factor.

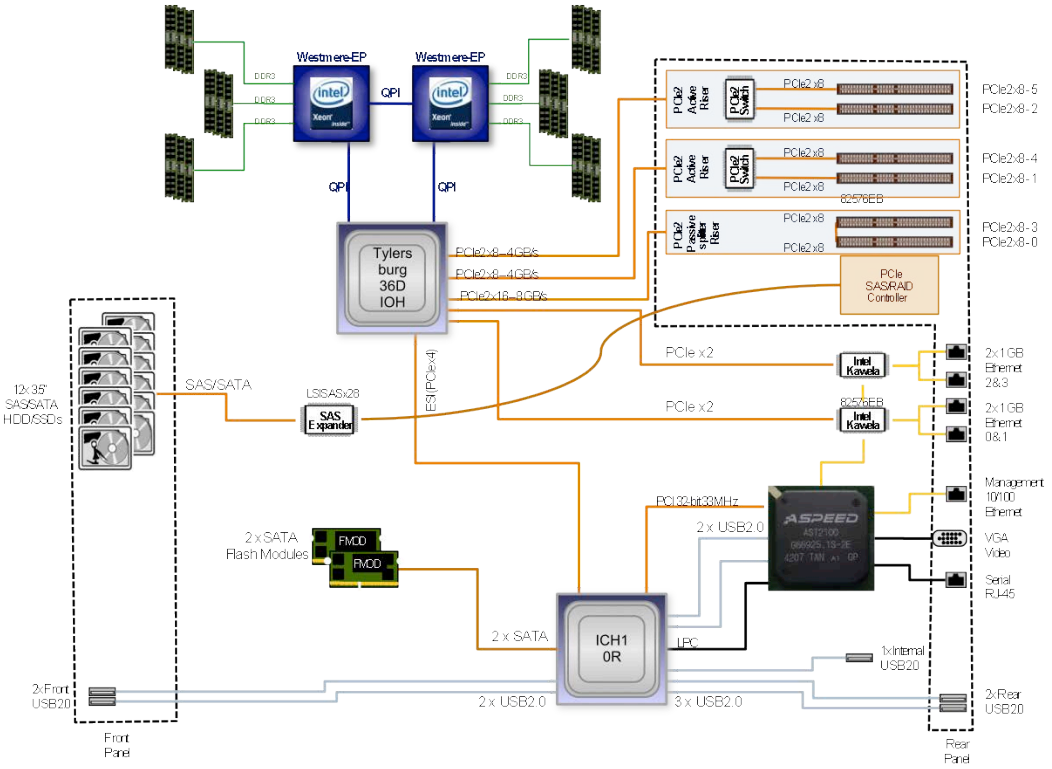

Figure 6. This block diagram provides a system-level view of the Sun Fire X4270 M2 -12 server with a SAS-2 HBA.

Sun Fire X4270 M2-12 Server Overview

The Sun Fire X4270 M2-12 server includes the following major components:

- One or two Intel Xeon Processor 5600 Series processors
- Up to 144 GB of memory (using 8 GB RDIMMs) populated in 18 RDIMM slots—4 GB or 8 GB RDIMMs are supported
- As many as twelve internal 3.5-inch SAS/SATA HDDs or SATA SSDs (using a PCIe SAS-2 HBA)
- Four onboard 10/100/1,000 Mb/sec Ethernet ports
- Six low-profile PCIe 2.0 slots, all eight-lane
- Five USB 2.0 ports
- An onboard ILOM service processor
- One or two hot-swappable, high-efficiency PSUs for N+1 redundancy

- Six hot-swappable, variable-speed fan modules (for N+1 redundancy), each with two fans operating under environmental monitoring and control

Sun Fire X4270 M2-12 Server Enclosure

The Sun Fire X4270 M2-12 server enclosure is designed to occupy 2U in a standard 19-inch rack (see Table 4).

TABLE 4. SUN FIRE X4270 M2-12 SERVER DIMENSIONS AND WEIGHT

DIMENSION	UNITED STATES	INTERNATIONAL
Height	3.34 in. (2 RU)	87.12 mm
Width	16.75 in.	425.5 mm
Depth	30.0 in.	762.0 mm
Weight	65 lb	29.54 kg

Sun Fire X4270 M2-12 Server Front and Rear Perspectives

Figure 7 illustrates the front and rear panels of the Sun Fire X4270.

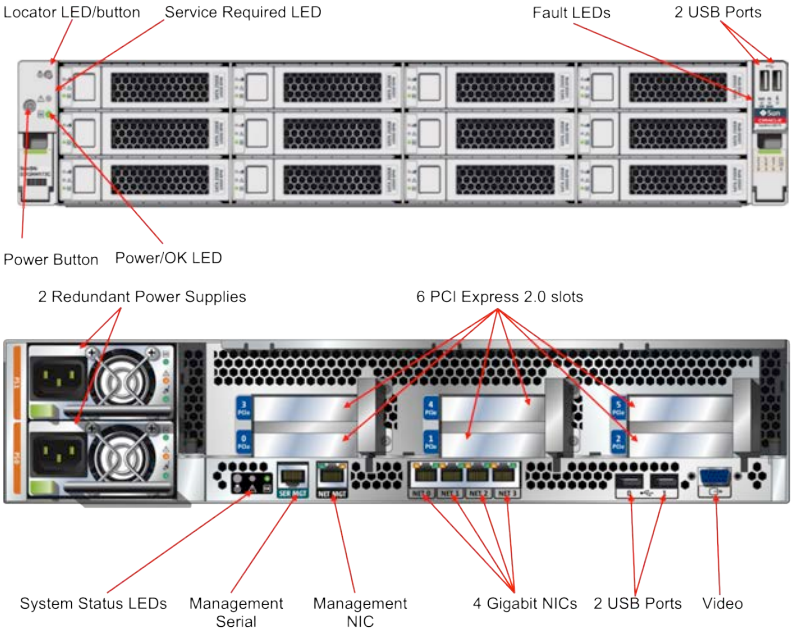

Figure 7. In these images of the Sun Fire X4270 M2-12's front and rear panels, you can see the server's external features and connections.

External features and connections include

- Front and rear status indicator lights, which report "locator" (white), "service required" (amber), and "activity status" (green) for the system and components
- As many as twelve 3.5-inch SAS/SATA HDDs or SATA SSDs, which insert through the front panel and interface with a PCIe SAS-2 HBA card
- Five USB ports: two on the front panel, two on the rear panel, and one internal (to attach internal boot devices)
- One or two power supply units (for N+1 redundancy) with integrated fans, with each power supply having a single, independent AC plug on the rear panel
- Rear power supply indicator lights, showing the status of each hot-swappable power supply
- Four 10/100/1000BASE-T autosensing Ethernet ports, accessible on the rear panel
- Six PCIe 2.0 slots, in which low-profile cards can be installed from the rear panel
- Two management ports on the rear panel (one 10/100BASE-T Ethernet port and one RJ45 serial port) for default connections to the service processor, with any one of the four onboard Ethernet ports also being configurable as a system management port
- VGA video port with an analog HD-15 VGA connector on the rear panel

Sun Fire X4270 M2-24 System-Level Architecture

Figure 8 is a system-level block diagram of the Sun Fire X4270 M2-24 disk server. With the new 2U chassis and disk enclosure design, this server can support up to twenty four 2.5-inch storage devices by use of a PCIe SAS-2 HBA card. The SAS expander does not interface to the ICH10R onboard disk controller. In the 2RU platforms, the onboard ICH10R SATA-II controller is only used to provide direct SATA-II connection to the rear mounted SATA disk cage, if installed. Sun Fire X4270 M2 servers with internal drives require a SAS-2 HBA, regardless of drive type installed in the disk chassis.

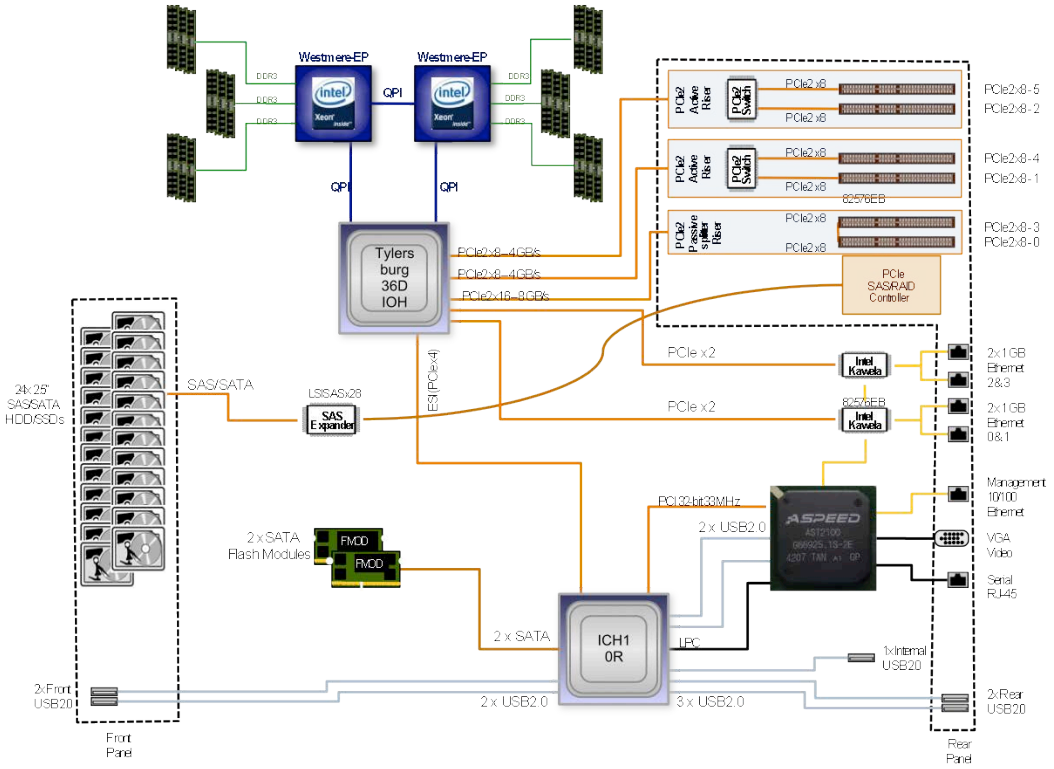

Figure 8. The Sun Fire X4270 M2-24 server's new 2U chassis and disk enclosure design enable it to support 24 x 2.5-inch storage devices by use of a PCIe SAS HBA card.

The Sun Fire X4270 M2-24 server supports as many as 24 internal SAS/SATA HDDs or SATA SSDs that use a 2.5-inch form factor.

Sun Fire X4270 M2-24 Server Overview

The Sun Fire X4270 M2-24 server includes the following major components:

- One or two Intel Xeon Processor 5600 Series processors
- Up to 144 GB of memory (using 8 GB RDIMMs) populated in 18 RDIMM slots— 4 GB or 8 GB RDIMMs are supported
- As many as 24 internal 2.5-inch SAS/SATA HDDs or SATA SSDs (using a PCIe SAS-2 HBA)
- Four onboard 10/100/1,000 Mb/sec Ethernet ports
- Six low-profile PCIe 2.0 slots, all eight-lane
- Three USB 2.0 ports
- An onboard ILOM service processor
- One or two hot-swappable, high-efficiency PSUs for N+1 redundancy

- Six hot-swappable, variable-speed fan modules (for N+1 redundancy), each with two fans operating under environmental monitoring and control

Sun Fire X4270 M2-24 Server Enclosure

The Sun Fire X4270 M2-24 server enclosure occupies 2U in a new 19-inch rack (see Table 5).

TABLE 5. SUN FIRE X4270 M2-24 SERVER DIMENSIONS AND WEIGHT

DIMENSION	UNITED STATES	INTERNATIONAL
Height	3.43 in. (2 RU)	87.12 mm
Width	16.75 in.	425.45 mm
Depth	30.0 in.	762.0 mm
Weight	65 lb maximum	29.54 kg

Sun Fire X4270 M2-24 Server Front and Rear Perspectives

Figure 9 illustrates the front and rear panels of the Sun Fire X4270 M2-24 server.

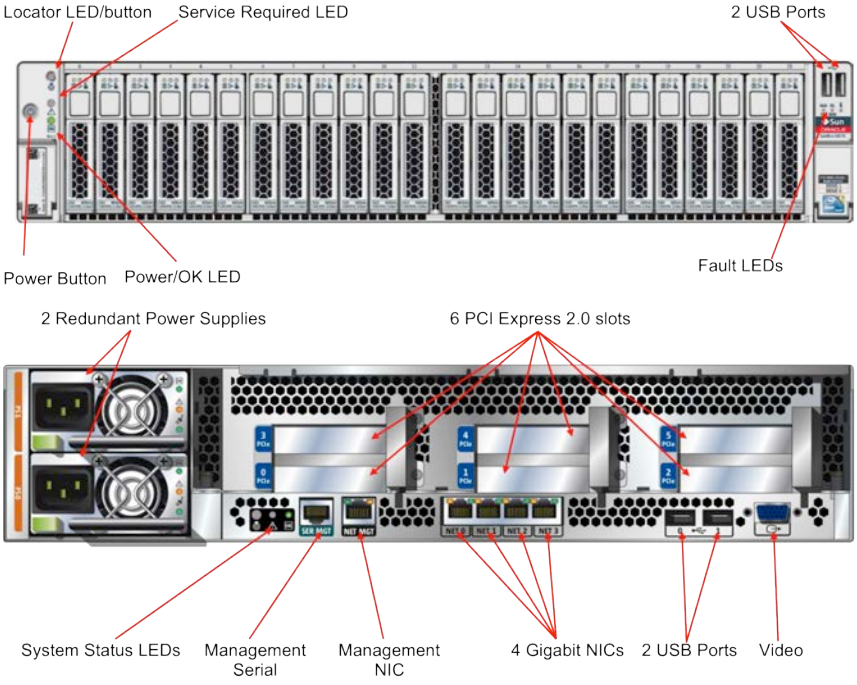

Figure 9. These front- and rear-panel views of the Sun Fire X4270 M2-24 server reveal its external features and connections.

External features include

- Front and rear status indicator lights, which report "locator" (white), "service required" (amber), and "activity status" (green) for the system and components
- As many as twenty four 2.5-inch SAS/SATA HDDs or SATA SSDs, which insert through the front panel and interface with a PCIe SAS-2 HBA card
- Three USB ports: two on the rear panel and one internal (to attach internal boot devices)
- One or two power supply units (for N+1 redundancy) with integrated fans, with each power supply having a single, independent AC plug on the rear panel
- Rear power-supply indicator lights, showing the status of each hot-swappable power supply
- Four 10/100/1000BASE-T autosensing Ethernet ports, accessible on the rear panel
- Six PCIe 2.0 slots, in which low-profile cards can be installed from the rear panel
- Two management ports on the rear panel (one 10/100BASE-T Ethernet port, one RJ45 serial port) for default connections to the service processor, with any one of the four onboard Ethernet ports also being configurable as the management port
- VGA video port with an analog HD-15 VGA connector on the rear panel

Optional Rear Dual 2.5" SATA Disk Cage

Customers using the Sun Fire X4270 M2 server in either 12 or 24 disk configurations can choose to install an optional replacement rear chassis panel that provides dual, rear mounted 2.5" SATA disk slots. This disk cage replaces two PCIe slots at the rear of the 2RU chassis, and is cabled to the internal ICH10R SATA controller.

Figure 10 is an illustration of the wiring and resulting architecture when the rear disk cage option is installed in a 2RU platform.

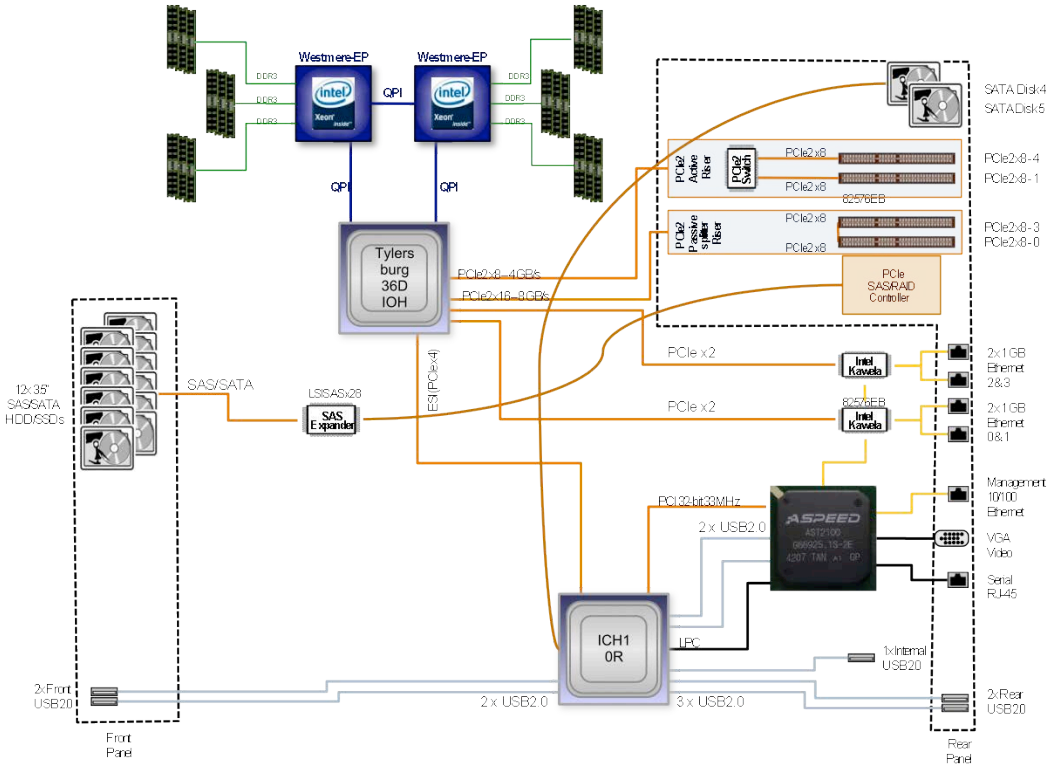

Figure 10. Example Disk controller wiring when using the optional Rear Dual SATA disk cage for the Sun Fire X4270 M2 Server

The Optional Rear dual disk cage replaces the rear panel of the server and replaces the two right-most PCIe slots of the conventional rear panel. This is illustrated in Figure 11.

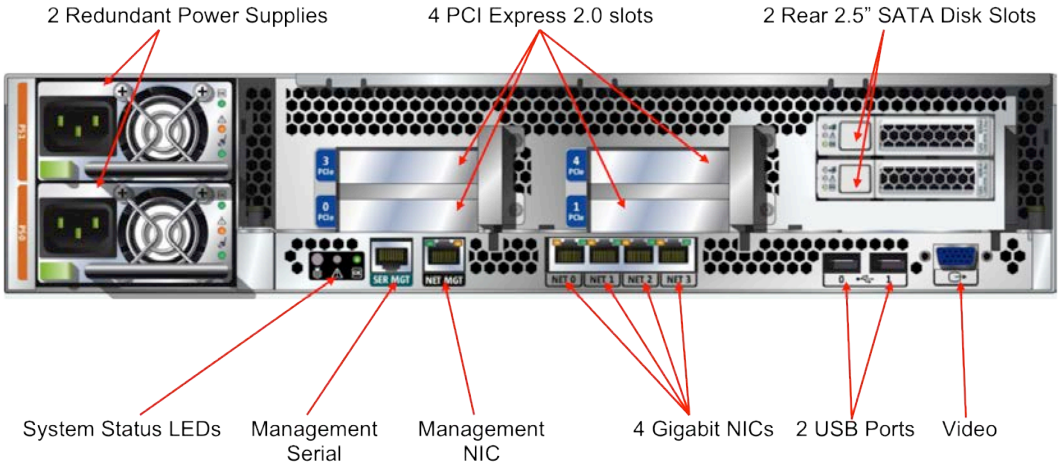

Figure 11. Example Disk controller wiring when using the optional Rear Dual SATA disk cage for the Sun Fire X4270 M2 Server

System Platform

The Sun Fire X4170 M2 and X4270 M2 servers are based on the Intel Xeon Processor 5600 Series platform, which includes

- **Intel Xeon Processor 5600 Series processors.** The motherboard of the Sun Fire X4170 M2 and X4270 M2 servers includes two processor sockets. (The section entitled "The Intel Advantage" describes the processor micro architecture.)
- **Intel 5520 I/O Handler (IOH).** The IOH (code-named Tylersburg-36D) features two QuickPath interconnects and 36 PCIe 2.0 lanes. Of the 36 PCIe 2.0 lanes, 32 connect to PCIe risers to enable PCIe 2.0 expandability. The remaining four lanes connect to two Intel 82576EB Gigabit Ethernet (Kawela) controllers to support the four onboard Ethernet ports.
- **Intel 82801JR I/O Controller Hub (ICH10R).** The ICH10R is interconnected to the IOH via one Enterprise South Bridge Interface (ESI) link, which is based on a four-lane PCIe interconnect with proprietary extensions and offers a 2 GB/sec transfer rate. The ICH10R enables additional I/O functionality, including support for system USB ports, the internal USB port, and the SATA DVD/RW device (available on the Sun Fire X4170 M2 server only). The ICH10R connects to the Aspeed AST2100 Service Processor via USB (for virtual devices), PCI (for video), and LPC (serial port).

Memory Subsystem

The integrated memory controller and multiple DDR3 memory channels per processor help provide high bandwidth for memory-intensive applications. The Sun Fire X4170 M2 and X4270

M2 servers can be populated with DDR3 Registered ECC DIMM modules in 4 GB or 8 GB capacities.

Each processor features an integrated memory controller, which means that the systems adhere to a NUMA memory architecture in which the memory controller on one processor can access local as well as remote memory. The integrated memory controller supports DDR3 memories in three speeds—800 MT/sec, 1,066 MT/sec, and 1,333 MT/sec—although Oracle qualifies and offers only 1,066 MT/sec and 1,333 MT/sec RDIMMs. When configuring system memory, it's important to note that DIMMs may run at speeds slower than individually rated speeds, depending on the CPU type, the number of DIMMs per channel, and the type of memory (speed, rank, and so on). The speed at which memory is actually running is set by system BIOS at startup, and all memory channels will run at the fastest common frequency.

Memory Population Guidelines

Each processor features three memory channels, each of which supports three RDIMM slots, enabling as many as 18 RDIMMs per system in a fully populated system. Memory slots in each channel are color-coded to simplify identification:

- Black represents slot 0.
- White represents slot 1.
- Blue represents slot 2.

As a general rule for optimizing memory performance, DIMMs should be populated in sets of three, one per channel per CPU, starting with the slot farthest from the CPU socket (in Slot 0, the blue slot). Ideally, each channel should be populated with equal-capacity DIMMs and (if possible) with the same number of identical DIMMs (which helps make memory performance more consistent). In a server with a single processor, the DIMM slots next to the empty CPU socket should not be populated. In general, it is better to populate quad-rank (QR) DIMMs first, followed by dual-rank (DR) DIMMs and/or single-rank (SR) DIMMs.[4]

Optimizing Memory for Bandwidth

Configurations with optimal memory bandwidth can be achieved with the Performance class of Intel Xeon Processor 5600 Series processors and memory components that run at 1,333 MT/sec. To optimize a configuration for bandwidth, populate one or two SR or DR DDR3 1,333

[4] "Rank" refers to the number of memory chips a DIMM module has connected on any given data line.

MT/sec DIMM per channel (the use of QR DIMMs limits the number of DIMMs per channel to two and restricts the maximum memory access speed to 800 MT/sec).

Optimizing Memory for Capacity

If three DIMMs per channel are populated to optimize for memory capacity, the memory access speed will be reduced to 800 MT/sec, regardless of the type of DIMMs (1,066 MT/sec or 1,333 MT/sec). For this reason, using 1,066 MT/sec DIMMs is recommended to reduce the configuration cost. With all 18 slots populated with 8 GB DIMMs, it is possible to achieve a maximum system memory capacity of 144 GB.

I/O Subsystem

With built-in headroom to expand systems and scale applications, the Sun Fire X4170, X4270, and X4270 M2 servers feature expandability through a PCIe 2.0 expansion bus, internal storage options, four onboard Intel gigabit network interface controllers (NICs), and integrated USB capabilities.

As shown in the block diagrams for the systems, the ICH10R provides connectivity for system USB ports, the internal USB port, and the SATA DVD/RW device (available in the Sun Fire X4170 M2 servers only). To enable USB 2.0 functionality on the Sun Fire X4170 M2 and X4270 M2 servers, two USB ports go from the ICH10R to the rear panel and one USB link is routed to the internal USB port, two additional USB ports are routed from the ICH10R to the front panel.

The ICH10R also includes a USB-to-SATA interface to connect the internal SATA DVD/RW drive on the Sun Fire X4170 M2 server.

System Network Interfaces

The IOH has four PCIe lanes that interface with two Intel 82576EB Gigabit Ethernet (Kawela) controllers. Each controller supports two onboard 10/100/1,000 Mb/sec Ethernet ports. Multiple onboard Gigabit Ethernet connections promote flexibility and enable configurations that support network interface failover.

The four Gigabit Ethernet ports are numbered in sequence from left to right on the rear panel. Each port autonegotiates its link connection, and LEDs above the port indicate the speed of the established link (green signifies that the established link is 1,000 Mb/sec). The Ethernet interfaces also support PXE boot for booting over the network.

The Sun Fire X4170 M2 and X4270 M2 servers feature the ability to configure any one of the four onboard Ethernet ports for "side band" management (see the "ILOM Service Processor and System Management" section). When configured as a management port, one of the onboard Ethernet interfaces has two MAC addresses and requires two IP addresses (one for data and one for management).

Just like the AST2100 service processor on the motherboard, the two Intel 82576EB Gigabit Ethernet controllers are powered from a "standby" power source from system power supplies. Even when power to the server is lost or turned off, the side-band management interface remains active to enable remote management.

PCIe 2.0 Expansion Bus

The Sun Fire X4170 M2 and X4270 M2 servers include a PCIe 2.0 expansion bus that can accommodate low-profile cards rated at 25 W maximum. PCIe 2.0 doubles the interconnect bit rate, increasing the aggregated bidirectional bandwidth of a 16-lane link to approximately 16 GB/sec. On each server model, three right-angle risers plug directly in to the motherboard to enable PCI 2.0 expansion. Single-slot 1U risers are used on the Sun Fire X4170 M2, versus dual-slot 2U risers on the Sun Fire X4270 M2 servers. Cards can be compliant with Revision 1.0a or 2.0 of the PCIe Card Electromechanical Specification and are installed with a horizontal orientation.

On the Sun Fire X4170 M2 server, the three PCIe 2.0 slots are numbered left to right (see Figure 5). Slot 0 uses an x16 mechanical riser (see Figure 12) and has 16 electrical lanes to the IOH. Slots 1 and 2 are located on x8 mechanical risers with eight electrical lanes. The risers are keyed to insert correctly into the motherboard.

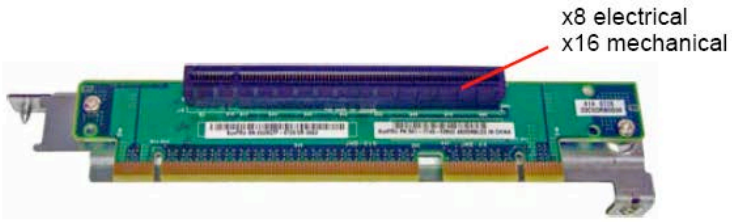

Figure 12. Slot 0—one of three PCIe 2.0 slots on the Sun Fire X4170 M2—uses an x16 mechanical riser.

The six slots on the Sun Fire X4270 M2 servers are numbered left to right across the bottom (Slots 0 to 2) and then left to right across the top of the rear panel (Slots 3 to 5). (See Figures 7 and 9, which shows the rear panel of the Sun Fire X4270 M2 servers, respectively.) Both 2U servers incorporate one passive riser (for Slots 0 and 3) and two active risers (for Slots 1 and 4, and Slots 2 and 5; see Figure 13). Each 2U riser supports two PCIe 2.0 slots for I/O expandability and is keyed to correctly insert into the motherboard. Each 2U riser provides two eight-lane (electrical and mechanical) slots, for a total of six x8 PCIe 2.0 slots in each 2U server.

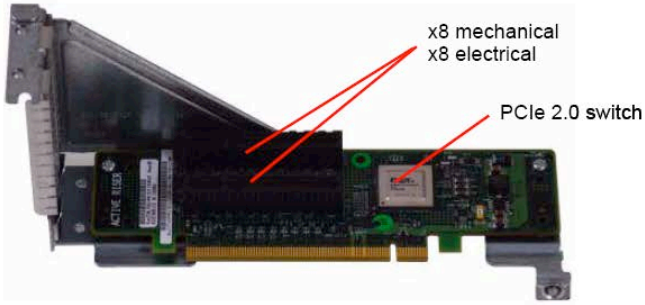

Figure 13. This image shows the PCIe 2.0 active riser for the 2U Sun Fire X4270 M2 server (Slots 1 and 4, 2 and 5).

The passive riser splits 16 PCIe 2.0 lanes from the IOH into two sets of eight lanes, one set for each riser slot. The active riser (see Figure 11) uses an IDT PES24T6G2 PCIe 2.0 switch to expand eight PCIe lanes from the IOH into two x8 slots. The PES24T6G2 switch features six ports and twenty-four 5 Gb/sec PCIe 2.0 lanes supporting 5 Gb/sec, 2.5 Gb/sec, and mixed 5 Gb/sec and 2.5 Gb/sec modes. As implemented in these servers, the switch provides high-performance I/O connectivity and switching functions between the riser's x8 PCIe 2.0 upstream port and the two x8 downstream ports. It supports eight traffic classes (TCs) and one virtual channel (VC) with sophisticated resource management algorithms (including round-robin, weighted round-robin, and strict priority schemes). The switch helps support PCIe applications that demand high throughput and low latency, such as high-throughput 10 Gb I/O cards, SATA controllers, and Fibre Channel HBAs. However, inserting more than one high-bandwidth and latency-sensitive PCIe card into slots managed by a single switch at the same time (for example, in Slots 1 and 4 or in Slots 2 and 5) is not recommended.

By default, Slot 0 on the Sun Fire X4170 M2 and X4270 M2 server is used for the HBA that connects to internal SAS/SATA HDDs or SATA SSDs. On the Sun Fire X4170 M2 server, the SAS HBA can be moved to Slot 2, if desired. On the Sun Fire X4270 M2 servers, it can be moved to Slots 2, 3, or 5. (On all three server models, a heat sink interferes with internal cabling to the HBA if the HBA is installed in a center PCIe 2.0 slot.)

Integrated Storage

The Sun Fire X4170 M2 and X4270 M2 servers offer large internal storage capacities for SAS or SATA HDDs and can also accommodate SATA SSDs. The servers differ, however, in the number and type of internal storage devices supported. Table 6 summarizes the differences.

TABLE 6. STORAGE CHARACTERISTICS OF THE SUN FIRE X4170 M2 AND X4270 M2 SERVERS

	SUN FIRE X4170 M2	SUN FIRE X4270 M2-24	SUN FIRE X4270 M2-12
Number of device slots	8	24 + 2x optional rear 2.5" SATA	12 + 2x optional rear 2.5" SATA
Device form factor	2.5 in. drive	2.5 in. drive	3.5 in. drive
Maximum number of internal SAS HDDs	8 (with PCIe SAS-2 RAID HBA) • 146 GB 10K • 300 GB 10K	24 (with PCIe SAS-2 RAID HBA) • 146 GB 10K • 300 GB 10K	12 (with PCIe SAS-2 RAID HBA) • 300 GB 15K • 2 TB 7K2
Maximum number of internal SATA HDDs	8 SATA HDDs with PCIe SAS RAID HBA or 4 with embedded SATA controller[5]	24 (with PCIe SAS-2 RAID HBA)[2]	12 (with PCIe SAS-2 RAID HBA)
Maximum number of internal SATA SSDs	4 SSDs using embedded SATA controller[3] 8 SSD's with PCIe SAS-2 RAID HBA	24 (with PCIe SAS-2 RAID HBA)	12 (with PCIe SAS-2 RAID HBA)

As Table 6 shows, the 1U Sun Fire X4170 M2 server can support as many as eight internal 2.5-inch HDDs or SSD's and the 2U Sun Fire X4270 M2 server can house as many as twenty four 2.5-inch internal HDDs or SSD's.

In the Sun Fire X4170 M2, the onboard SATA controller supports as many as four directly attached SATA HDDs or SATA SSDs (although these configurations do not provide any RAID capabilities). A PCIe SAS-2 RAID HBA card is required to fully populate all eight slots with SATA or SAS devices and to implement RAID. In the 2U Sun Fire X4270 M2 servers, the PCIe SAS-2 RAID HBA is needed in all configurations to support internal storage options. Internal mixing of SATA and SAS devices is supported (but not within a RAID volume).

[5] The onboard SATA controller provides no RAID functionality. Use the PCIe SAS-2 RAID HBA card to implement RAID configurations.

Available Devices

The following devices are available for the Sun Fire X4170 M2 and X4270 M2 servers (at the time of this writing):

- SAS HDDs
  - 2.5-inch SAS disks: 146 GB and 300 GB 10K RPM
  - 3.5-inch SAS disks: 300 GB 15K RPM and 2 TB 7,200 RPM
- SATA HDDs
  - 2.5-inch SATA disks: 500 GB, 7,200 RPM (for use in X4270 M2 rear disk cage only)
- SATA SSDs
  - 2.5-inch SFF SATA SSDs: 32 GB
  - 3.5-inch SATA SSDs: 32 GB

Solid-State Drives (SSDs)

Modern servers are driving throughput levels that rapidly outpace the throughput capabilities of typical storage solutions. Although many servers can achieve processing capabilities in excess of a million I/O operations per second (IOPS), today's fastest hard disk drives are capable of only 300 IOPS to 400 IOPS. To match throughput more closely to server performance and meet the challenging demands of data-intensive applications, many data centers implement large pools of high-speed disk drives. In some cases, a large buffer of expensive DRAM is also deployed so that the application's working set can be stored in memory to reduce latency.

Flash technology provides a more economical alternative that can dramatically enhance application I/O performance while also operating with significantly better energy efficiency than conventional rotational HDDs. The Sun Fire X4170 M2 and X4270 M2 servers support flash technology in the form of SSDs.

Recent advances in the quality of flash technology have made SSDs an effective and reliable solution for enterprise storage, enabling a new strategy for implementing tiered storage solutions. Because Flash offers low latency, these devices fall into a cost and performance sweet spot between mechanical drives and DRAM and thus can provide tremendous value in conjunction with I/O-intensive workloads. SSDs use a drive form factor and are directly inserted into drive bays specific to the Sun Fire X4170 M2 and X4270 M2 servers. The servers' operating system and BIOS view SSDs as standard SATA drives.

Optimizing Performance with SSDs and FlashFire technology

Taking advantage of the performance and cost characteristics of Flash technology requires an enabling technology that can transparently use it to drive better application and file system

performance. Oracle Solaris Zettabyte File System (ZFS) enables data center architects to balance performance requirements against cost by using a variety of device types to store, archive, and access information. Creating a Hybrid Storage Pool in Oracle Solaris ZFS leverages the strengths of both rotational and solid-state storage media. A Hybrid Storage Pool automatically places data on the most-appropriate storage media to optimize performance and manage costs, and Oracle Solaris ZFS can transparently cache data on Flash without requiring applications to be modified. Oracle Solaris ZFS recognizes different media types and optimizes data placement to maximize system throughput.

Drive Cage Design

The impressive storage density of the Sun Fire X4170 M2 and X4270 M2 servers is attributable partly to innovative drive carrier designs that facilitate effective airflow above and below each drive. Drives insert into a disk tray and cable-free disk backplane that increases reliability and serviceability. The carrier includes an ejection handle that simplifies drive removal (drives are hot-pluggable when disk mirroring is configured). Drive status lights indicate Ready to Remove, Fault, and Status.

In all three systems, the disks plug in to a server-specific backplane board. In the Sun Fire X4270 M2 servers, an LSI SAS-2 expander device facilitates large internal storage capacities. On the Sun Fire X4270 M2's, eight ports on the SAS expander connect to the SAS HBA, supporting switched connections for as many as 24 SAS or SATA devices.

To minimize the effects of drive or fan vibration, dampening material was added to the server's drive cages and the fan modules and deck were designed with a floating spring mechanism that helps isolate fan vibration. In addition fan modules containing two contra-rotating fans were specified that help reduce the amplitude of fan vibration.

Disk Controller and I/O RAID Options

The Sun Fire X4170 M2 and X4270 M2 servers support the following options for disk controllers:

- **Embedded SATA II controller on the motherboard (Sun Fire X4170 server only).** This controller supports as many as four internal SATA HDDs or SSDs (but it does not include any hardware RAID support).
- **Sun StorageTek SAS-2 HBA.** A low-profile card, the external version of this controller offers no RAID support and has two external four-port SFF-8088 connectors. The internal version of this HBA has two internal four-port SFF-8087 connectors and enables hardware RAID levels 0, 1, or 10.
- **Sun StorageTek SAS-2 RAID HBA (which supports 6 GB/sec SAS-2 and hardware RAID levels 0, 1, 1E, 5, 5EE, 6, 10, 50, and 60).** Based on Adaptec and Intel technology, this HBA is an eight-channel, low-profile card with two four-port SFF-8087 connectors. The card is available in two versions: one with internal connectors and one with external connectors.

This HBA includes 256 MB of DDR2 memory onboard and a battery-backed write cache for 72-hour backup, which helps deliver protected, high-availability storage.

Two cables with four lanes (each at 6 Gb/sec) each are wired from the SAS adapter to the disk backplane to control the internal HDD and SSD drives and provide high bandwidth. For the Sun Fire X4170 M2, the four SAS links from the HBA connect directly to the SAS/SATA devices. In the case of the Sun Fire X4270 M2 servers, the four SAS links connect to the SAS expander, which provides connections to individual disks in the drive cage.

DVD/USB Assembly

A slim form factor SATA DVD/RW assembly is available as an option for the Sun Fire X4170 M2 servers. The assembly provides an internal DVD-RW device as well as two USB ports accessible from the front panel. A locking handle enables the assembly to be safely secured and more easily extracted from the system chassis. The Sun Fire X4170 M2 servers can also be ordered with an assembly that features two USB ports only (and no DVD device).

Power Supplies

Engineered for high availability as well as low energy consumption, the Sun Fire X4170 M2 and X4270 M2 servers can be configured with two highly efficient, "Gold" standard, redundant, hot-swappable AC PSUs, each with separate power cords. Configuring a system with a second power supply enables N+1 redundancy, supplying continuous power to the system if a single power supply fails.

The PSUs differ between systems, with the Sun Fire X4170 M2 server using 760 W PSUs and the Sun Fire X4270 M2 servers requiring 1,200 W PSUs. As shown in Table 7, the power supplies are highly efficient, with an efficiency rating of at least 85 percent at 100 percent load.

TABLE 7. POWER SUPPLY UNIT COMPARISON

SYSTEM	MAXIMUM OUTPUT POWER	MAXIMUM AC INPUT CURRENT	POWER SUPPLY EFFICIENCY
Sun Fire X4170 M2	760 W	At 100 V AC and 760 W output: 9.0 A	At 760 W (100%) load: 87%
Sun Fire X4270 M2	1,200 W	At 100 V AC and 1,200 W output: 12.4 A	At 1,200 W (100%) load: 85%

Each PSU features a non-removable internal fan that supplies independent PSU cooling. Three light indicators display power supply status information (AC, Fault, and OK).

The Sun Fire X4170 M2 and X4270 M2 servers use a power distribution board (PDB) that provides connections between the power supplies and major system components. The PDB

contains a single 12-volt-to-5-volt DC-to-DC supply used to power the disk subsystem and the optional DVD-RW device.

Fan Assemblies

The server enclosures are designed for efficient front-to-back airflow. Variable-speed fans run under the control of the onboard service processor, which monitors processor temperatures and system ambient air temperature. Based on these readings, the fans operate at the lowest speeds possible to provide sufficient cooling—conserving power use, prolonging fan life, and reducing acoustical noise.

Fan assemblies differ between the Sun Fire X4170 M2 and X4270 M2 servers. The Sun Fire X4170 M2 server houses seven fan modules, with each module containing two 40 mm, 10,000 RPM fans. In the Sun Fire X4270 M2 servers, there are six fan modules, with each module accommodating two hot-swappable 60 mm fans.

Each Fan module consists of two fans, configured to contra-rotate to reduce vibration modes, and do not contain any additional components. Fan status LED's are located at the side of the chassis. A green status light for a fan module indicates proper operation, whereas an amber light indicates a fan fault. Fan modules on these systems are designed for redundancy—a backup fan enables system continuity in the event of a fan failure. The fans are also hot-swappable, which means that it is possible to remove a module with a failed fan and insert a new fan module without shutting down the system. On the top of the chassis, a fan access door enables servicing of the fans with the chassis pulled only partially out of the rack. This simplifies cable management during fan replacement.

Rack Mounting

The Sun Fire X4170 M2 and X4270 M2 servers can be mounted in the following racks:

- Third-party ANSI/EIA-310-D-1992 or IEC 60927-compliant racks in 19 in./482.6 mm panel-width series
- Sun Rack II 1042 and 1242

The Sun Fire X4270 M2 servers are best rack-mounted in the Sun Rack II 1242 due to the extra depth available in this rack. They can also be rack-mounted in the Sun Rack II 1042 (with some limitations due to the depth of the chassis, particularly with the cable management arm; see the documentation for more details). As a part of its chassis, the Sun Fire X4270 M2 servers feature slide rail release levers (see Figure 9). Pulling down on these levers unlocks the rails' sliding mechanism so the chassis can be pulled out of the rack for easier servicing.

The following options are available to simplify rack mounting:

- **Rack-mounting slide rail kit.** This is a four-point mounted slide rail kit (mounting points are located at the rack front and rear).

- **Tool-less rack kit.** As the name implies, this rack-mounting kit snaps into certain Oracle and third-party racks without requiring the use of any tools.
- **Cable management arm.** The cable management arm supports and protects cables as the server slides in and out of the rack.

The slide rail kit includes hardware for mounting it to rack rails with either 6 mm threaded holes, #10-32 threaded holes, #10 clearance holes, or square unthreaded holes per ANSI/EIA 310-D-1992 or IEC 60927 standards. Note that not all third-party racks are compatible with the slide rail kit. Rack density will vary widely, depending on the systems installed, power distribution (in-cabinet or external), the power source (single-phase or three-phase), and whether redundant power is required.

RAS Features

Corporate data and business information are critical business assets. Enterprise computing technologies strive to furnish a high degree of data protection (reliability), provide virtually continuous application access (availability), and incorporate procedures and components that help resolve problems with minimal business impact (serviceability). Commonly referred to as RAS, these capabilities are a standard part of Oracle's mission-critical computing solutions.

The Sun Fire X4170 M2 and X4270 M2 servers are engineered for hardware failure prevention, near-continuous operation, fast recovery, and easy serviceability. RAS features for these systems include

- **High CPU density.** Multiple Intel Xeon processors in 1U and 2U form factors enable density that increases overall availability.
- **Hot-swappable redundant components.** Mirrored disks, redundant fan modules, and redundant PSUs can be quickly and easily changed out, increasing system uptime.
- **Accessible components for improved serviceability.** Front-accessible, hot-swappable disk drives can be replaced quickly. The optional DVD/RW drive can also be removed without the top cover of the chassis being open, and fan modules and power supply units can be replaced even if a system has not been completely removed from the rack.
- **A variety of RAID options.** These options enable customers to balance storage capacity, availability, and cost. The LSI-based Sun StorageTek SAS-2 HBA with internal connectors supports RAID 0, 1, 1E, and 10E, and the Sun StorageTek SAS-2 RAID host bus adapter supports RAID 0, 1, 10, 1E, 5, 50, 5EE, 6, and 60 and also features a battery-backed disk write cache.
- **Indicator LEDs on the front and back of the chassis.** Easily visible LEDs enable problems to be identified and isolated easily. Diagnostic LEDs are also included on the motherboard.
- **ILOM capabilities.** Standard on the Sun Fire X4170 M2 and X4270 M2 servers with basic functionality, and can be augmented by purchasing ILOM Professional edition licenses to

obtain more capability, The integrated ILOM service processor provides powerful tools for local or remote system management, simplifying administrative tasks, reducing the number of onsite personnel needed, and lowering overall operational costs. (See the next section—"ILOM Service Processor and System Management"—for more on the servers' system management capabilities.)

ILOM Service Processor and System Management

The need for high availability in business-critical systems calls for robust and proactive system management. Like many other Oracle servers, the Sun Fire X4170 M2 and X4270 M2 servers feature a built-in hardware-based service processor that enables remote server monitoring, system management, and task automation capabilities that are consistent across much of the Oracle server product line.

Sun ILOM Service Processor

The Sun Fire X4170 M2 and X4270 M2 servers embed an Aspeed AST2100 chip as the onboard service processor (that is, the baseboard management controller, or BMC). The Aspeed AST2100 combines a graphics controller and a service processor into a single chip, saving space and power. It uses two USB ports for virtual devices and one 32-bit, 33 MHz PCI bus for video to connect to the ICH10R. (See the system block diagrams in the earlier "Sun Fire X4170 M2 and X4270 M2 Server Architecture" section.)

The Sun ILOM service processor provides lights-out management, which can help organizations simplify system management. The service processor runs independently of the host platform, executing a robust, security-hardened operating system.

The capabilities of the Sun ILOM service processor include the following:

- Full local and remote keyboard, video, mouse, and storage (RKVMS) access via redirection over IP, eliminating the need for KVM
- Monitoring and reporting of environmental, power, hardware, BIOS, and operating system events
- Remote power control, diagnostics, virtual media attachment and upgrades of the system BIOS and service processor software
- System configuration information retrieval
- User-configurable serial console access through a physical port or redirected over IP
- Java-enabled remote console access across a secure Web connection

- Multilevel role-based access with support for RADIUS, LDAP, and Microsoft Active Directory Service lookup of authentication data
- Simple Network Management Protocol (SNMP) V1, V2c, and V3 support

For system management operations, the Aspeed AST2100 uses these connections:

- Two USB ports for virtual devices (both ports are routed directly on the motherboard between the AST2100 and the ICH10R)
- Two serial ports (one external, one to the ICH10R)
- Two Ethernet interfaces for IP-based management connections (one external for out-of-band management, one to the Intel NIC controllers for side-band management)
- One SVGA video port for local video output
- One 33 MHz, 32-bit PCI connection to the ICH10R for video

Management functions provided by the service processor are implemented by ILOM 3.0 system management software. This software provides an Intelligent Platform Management Interface (IPMI 2.0) baseboard management controller, platform control agents, diagnostics software, and RKVMS functionality. Many other Oracle servers incorporate these features, providing organizations with a single, consistent, and standards-based management interface.

Secure access to the service processor and associated ILOM software functions takes several forms:

- Intuitive browser-based user interface (BUI) over SSL
- Distributed Management Task Force (DMTF) command-line interface over Secure Shell (SSH)
- Redirection of the platform console, keyboard, mouse, and video to the ILOM Remote Console application
- SNMP v3 interfaces, providing easy integration with Oracle Enterprise Manager Ops Center, or third-party applications from companies such as HP and IBM
- IPMI 2.0 command interface for remote management with IPMI-based tools such as IPMItool

Optimizing Management Flexibility

Although system management tools can play an important role in streamlining operations, organizations must consider the best approach for each environment. Executing management software directly on the host (with or without use of a service processor) is known as in-band management. Using a dedicated Ethernet or serial port to execute administrative tasks independently of the host is known as out-of-band management. Sharing a single Ethernet port for host and service processor network connectivity is called side-band management, which is enabled in these servers through a connection between the Ethernet controllers and the service processor (see Figure 14). Table 8 presents a comparison of these management strategies.

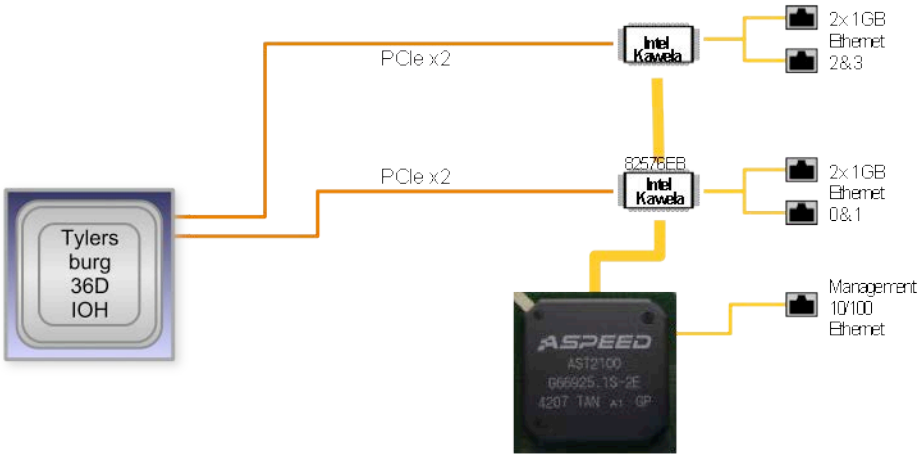

Figure 14. The Sun ILOM service processor supports side-band management.

TABLE 8. COMPARISON OF IN-BAND, OUT-OF-BAND, AND SIDE-BAND MANAGEMENT

STRATEGY	CHARACTERISTICS	BENEFITS	IDEAL USE CASES
In-band	• It relies on operating-system-resident software. • Management tasks utilize platform compute resources.	• Use of a single network connection and switch port minimizes cost and complexity.	• Heterogeneous environments to provide a common administrative tool across all platforms
Out-of-band	• It utilizes a dedicated Ethernet or serial port for administrative traffic. • Management tasks execute on an independent service processor.	• It provides continuous access to management capabilities even when the host is disabled. • Management tasks do not consume host resources. • Increased security is a result of physically separating management traffic and server data.	• Environments with compute- or bandwidth-intensive applications • Projects with complex management requirements or high levels of administrative burden

Side-band	• The host and service processor share an Ethernet port and are each assigned an independent MAC and IP address. • Management tasks execute on an independent service processor.	• It provides continuous access to management capabilities even when the host is disabled. • Management traffic uses part of the server data bandwidth. • It requires only one switch port, lowering implementation costs. • It minimizes processing overhead on the host.	• Cost-sensitive environments

The Sun Fire X4170 M2 and X4270 M2 servers offer extensive flexibility, in that they support all three of these strategies—in-band, out-of-band, and side-band management. Organizations can choose a single management method or use in-band management in tandem with out-of-band or side-band management approaches.

The Sun Fire X4170 M2 and X4270 M2 servers provide out-of-band management across a dedicated 10/100 Mb Ethernet port or an RS-232 serial port on the ILOM service processor. Side-band management is supported over one of the four Gigabit Ethernet interfaces shared between the host and the service processor. With a side-band management approach, both the platform and the service processor get a unique MAC address and IP address for the shared physical Ethernet port. When configured, side-band management can provide all the benefits of out-of-band management at a considerable cost savings, by eliminating the need to consume a switch port for both management and platform connections.

In-Band Server Management

In-band server management enables organizations to take advantage of industry-standard protocols and applications across all data center platforms. The Sun Fire X4170 M2 and X4270 M2 servers facilitate in-band server management by supporting IPMI 2.0 and SNMP v1, v2c, and v3 standards. One of the following two options enables these OS-resident platform management functions:

- IPMI with a keyboard-controller-style (KCS) interface and an IPMI kernel driver
- SNMP agents

Out-of-Band and Side-Band Management

Out-of-band and side-band management approaches support the completion of administrative tasks without placing an unnecessary burden on the host. This administrative strategy is desirable for performance-intensive environments. Although in-band management works only as long as

the host operating system is up and running, out-of-band and side-band management are fully functional even when the host is powered off. For side-band management to work even when the host is shut down, the two dual-Gigabit Ethernet (Kawela) controllers operate with standby power, much like the service processor.

Although out-of-band and side-band approaches differ with respect to network connectivity, these methods offer comparable capabilities and benefits:

- Based on serial port redirection (serial-over-LAN), serial port connectivity to the ILOM service processor provides direct console access to the command-line interface (CLI) and to the system console stream. The CLI is designed to follow the DMTF Command Line Protocol.
- Utilizing Ethernet connectivity, administrators can access a Web interface or a CLI. An SSH session is required to access the CLI, and the Web interface supports both secure (https) and nonsecure (http) access. Secure access is the default configuration for Web-based access.

Remote Keyboard, Video, Mouse, and Storage

The ILOM service processor provides access to keyboard, video, mouse, and storage remotely over IP. Remote video display is accomplished through the Java Web Start software known as ILOM Remote Console. Setting up a system as a remote console means downloading ILOM Remote Console software from the ILOM service processor to the target machine.[6] From this point on, the ILOM Remote Console executes locally. Because ILOM Remote Console does not run locally on the server, it does not put overhead on the host. A single instance of ILOM Remote Console can open multiple sessions, enabling management of several remote servers simultaneously.

ILOM Remote Console software can be used to redirect the BIOS and setup screens as well as all other platform video output. A true remote video view of the management console is provided by handling of the input and output to and from virtual devices and the server. With 8- and 16-bit support and 8 MB of video memory, the SVGA display provides resolutions as high as 1,280 × 1,024 pixels.

The two USB 2.0 ports connected to the ILOM service processor enable the remote keyboard, mouse, and storage functions. The ILOM Remote Console software captures keyboard, mouse and floppy/CD/DVD input on the management console and redirects it over IP to the ILOM service processor. Keyboard, mouse, and storage inputs are then transmitted over the USB ports

[6] ILOM Remote Console requires the installation of Java Runtime Environment 5.0 on the management console.

to the server. The Sun Fire X4170 M2 and X4270 M2 servers interpret these inputs as originating from locally connected USB devices, which are referred to as "virtual" devices.

ILOM Remote Console can also be used to boot the remote server from a local device. A virtual device can be a local physical device or an image file. ILOM Remote Console can redirect several types of devices as virtual devices:

- CD/DVD-ROM
- Floppy
- USB flash disk drives
- CD/DVD-ROM image (.iso files)
- Floppy image (.img files)

Intelligent Platform Management Interface

IPMI platform management refers to the autonomous monitoring, logging, recovery, and inventory control features implemented in hardware and firmware. The key differentiation of intelligent platform management is that these functions are independent of the main CPU, BIOS, and OS. There are two major components of platform management: the baseboard management controller (BMC) and system management software (SMS). Intelligent platform management facilitates enterprise-class management for high-availability systems.

The ILOM service processor provides autonomous sensor monitoring and event logging. Typical sensor-related events include out-of-range temperatures or voltage and fan failures. When an event occurs, it is noted in the system event log and made available to the system management controller. The system management controller is powered by power supply standby voltage and will function even when the server is powered down or the operating system has crashed. As a result, the platform status can be obtained and recovery initiated even in situations in which in-band delivery mechanisms are unavailable.

In modern systems, IPMI provides a hardware-level interface specification for monitoring and control functions. It defines a standard, abstract, message-based interface between the BMC and SMS and a common set of commands for operations such as accessing sensor values, setting thresholds, logging events, and controlling a watchdog timer. IPMI messages can be used to communicate with the BMC over serial and LAN interfaces, so taking software designed for in-band (local) management and reusing it for out-of-band (remote) management simply means changing the low-level communications layer.

SNMP

Simple Network Management Protocol (SNMP) provides remote access for monitoring and controlling network devices and for managing configurations, statistics collection, performance, and security on a network. SNMP is a network management protocol used almost exclusively in

TCP/IP networks. The Sun Fire X4170 M2 and X4270 M2 servers provide SNMP Management Information Bases (MIBs) for managing and monitoring the servers with any SNMP-capable network management system, such as HP OpenView Network Node Manager (NNM), Tivoli, CA Unicenter, or IBM Director. The MIB data describes the information being managed, reflects current and recent server status, and provides server statistics.

The ILOM service processor supports SNMP v1, v2c, and v3. SNMP v3 is enabled by default; v1 and v2c are disabled by default. SNMP sets can be enabled and disabled and are disabled by default. SNMP traps can be generated from within the service processor. An IPMI-specific trap called a platform event trap (PET) can also be generated. The following SNMP MIBs are supported:

- The system group and the SNMP group from the RFC1213 MIB
- SNMP-FRAMEWORK-MIB
- SNMP-USER-BASED-SM-MIB
- SNMP-MPD-MIB
- ENTITY-MIB
- SUN-PLATFORM-MIB

Oracle Enterprise Manager Ops Center

Oracle Enterprise Manager Ops Center is a highly scalable data center management platform that provides organizations with fluid systems lifecycle management and automation process. The capabilities of Oracle Enterprise Manager Ops Center can help organizations simplify management of data center requirements such as server consolidation, compliance reporting, and rapid provisioning. This management platform helps provision and administer both physical and virtual data center assets in environments that include Sun Fire X4170 M2 and X4270 M2 servers as well as other Oracle and non-Oracle hardware running Windows and Linux operating systems and Oracle Solaris.

Oracle Enterprise Manager Ops Center provides a single console to facilitate the following key capabilities within globally dispersed heterogeneous IT environments:

- **Server discovery and inventory management.** Oracle Enterprise Manager Ops Center automatically scans and identifies servers across the network, even when powered off, enabling faster deployment and management of IT assets.
- **Firmware and bare-metal server provisioning.** Oracle Ops Center Provisioning and Patch Automation delivers automatic "hands off" installation of bare-metal operating systems, RPMs, and firmware, bringing new efficiencies to IT departments.
- **Patch management and updating.** Oracle Ops Center Provisioning and Patch Automation provides up-to-date patch management tools for Red Hat, SUSE, and the Solaris OS, offering

organizations greater control over data center plans and minimizing downtime. In addition, unique patch simulation capabilities remove uncertainty from the software update process.

- **Management and monitoring.** Oracle Ops Center Provisioning and Patch Automation securely and remotely manages users and heterogeneous data center assets and proactively resolves problems by monitoring critical parameters, improving the security and stability of systems.
- **Compliance reporting.** Oracle Enterprise Manager Ops Center provides an up-to-date view into the system state, patch status, and software portfolio, helping improve the speed and accuracy of report and compliance validation.

These automation capabilities can be used in conjunction with configuration management investments to achieve knowledge-based change management. Taking advantage of Oracle Enterprise Manager Ops Center can help organizations create a more compliant Oracle Solaris environment that requires less maintenance and recovery downtime and can lead to considerable cost savings.

Enterprise-Class Software Support

To provide both flexibility and investment protection, the Sun Fire X4170 M2 and X4270 M2 servers support multiple 64-bit operating systems, including Oracle Solaris 10 and Oracle Enterprise Linux, Oracle VM, RedHat Linux, SuSE Linux , Microsoft Windows and VMware environments. Qualification of multiple operating systems enables organizations to deploy a choice of application environments without having to shift hardware platforms when software requirements change. This added flexibility enables enterprises to reduce cost and complexity when supporting and managing solutions from multiple vendors, helping organizations reduce risk and increase ROI.

The Sun Fire X4170 M2 and X4270 M2 servers are certified to run a range of operating systems, please check the Oracle product web pages for current lists of supported OS versions, at http://www.oracle.com.

Additional patches and drivers required to complete the installation of some these operating systems are available on the Tools and Drivers CD-ROM, this can be specified at order time for a nominal charge. It is also possible to download the image for this CD-ROM from the product web-pages.

The Oracle Solaris Operating System

Oracle and Intel have worked together to ensure that Oracle Solaris is optimized to unleash the power and capabilities of current and future Intel Xeon processors. Since 2007 engineering teams from both companies have delivered a range of enhancements for Oracle Solaris on Xeon processors, optimizing the manner in which Oracle Solaris and the new Intel Core micro

architecture work together on Intel Xeon processor 5600 Series processors. The results have been compelling:

- **Improved performance.** Oracle OS takes advantage of Intel Xeon Processor 5500 Series features—including Intel Hyper-Threading Technology, Intel Turbo Boost Technology, and Intel QuickPath Technology—to deliver significant performance improvements.
- **Automated power efficiency and utilization.** Optimized to leverage Intel's power management functions, Oracle Solaris delivers improved energy efficiency and performance per watt through integrated power gates and automated power states.
- **Increased reliability, availability, and serviceability.** The Oracle Solaris Fault Management Architecture (FMA) infrastructure takes advantage of the Intel Xeon Processor 5500 Series RAS features to provide an even stronger enterprise computing solution.
- **Virtualization enhancements**. Oracle Solaris delivers cost-effective virtualization through Intel Virtualization Technology features.

Distributed under a commercial and open source licensing model, Oracle Solaris 10 offers many innovative technologies that change the equation for organizations that need to reduce costs, minimize complexity, and eliminate risk. Oracle Solaris 10 is optimized for Oracle systems and supported on more than one thousand third-party x86 systems. In addition, Oracle Solaris 10 is free for download without a requirement to purchase a support contract, offering an economic advantage over other community-based operating system offerings. Oracle Solaris 10 also includes more than 180 applications from the free and open source software (F/OSS) community, and thousands of others are freely available for download over the internet.

The Oracle Solaris includes features not found in any other operating system, including

- **Oracle Solaris DTrace.** This powerful tool provides a true, system-level view of application and kernel activities, even those running in a Java Virtual Machine. System administrators, integrators, and developers can use this dynamic instrumentation to reduce the time to diagnose problems from days and weeks to minutes and hours, providing faster fixes.
- **Oracle Solaris Containers.** Providing a powerful approach to virtualization and software partitioning, this technology yields many private execution environments within a single instance of Oracle Solaris. Using this technology, organizations can improve resource utilization, reduce downtime, and lower solution costs.
- **Oracle Solaris Predictive Self-Healing.** This technology automatically diagnoses, isolates, and recovers from many hardware and application faults. As a result, business-critical applications and essential system services can continue uninterrupted in the event of software failures, major hardware component breakdowns, and software misconfiguration problems.
- **Resource management.** The built-in resource management facilities in Oracle Solaris 10 enable computing resources to be allocated among individual tasks and users in a structured,

policy-driven fashion. Using the Oracle Solaris resource management facilities to proactively allocate, control, and monitor systems, it's easy to provide fine-grained management of resources such as CPU time, processes, virtual memory, connect time, and logins. The result is more-predictable service levels.

Linux Environments

Oracle has qualified the leading Linux variants on the Sun Fire X4170 M2 and Sun Fire X4270 M2, including Oracle Enterprise Linux, Red Hat Enterprise Linux and Novell SUSE Linux Enterprise Server.

Oracle is one of the largest contributors to the open-source community. Areas of contribution include OpenOffice.org, Mozilla, GNOME, and X.org. In addition, Oracle provides key software offerings for Linux, including the following:

- Lustre parallel file system
- Sun Ray Software
- Oracle Enterprise Manager Ops Center
- Oracle Open Office
- Java Desktop System
- Oracle Solaris Studio, Java Studio Creator, and NetBeans
- MySQL database

Microsoft Windows Environments

Organizations strive to reduce the variety of platforms present in their data centers—even in the face of a wide range of workloads. To assist in this effort, the Sun Fire X4170 M2 and X4270 M2 servers can all run the Microsoft Windows operating environment (and have, in fact, passed stringent Microsoft compatibility test suites).

VMware Environments

Virtualization solutions from VMware help improve asset utilization, operational efficiency, and business agility. VMware virtualization technology also combines with key Oracle Solaris 10 features such as DTrace, Oracle Solaris Containers, and Oracle Solaris Predictive Self-Healing software. As a result, organizations can create powerful IT solutions through virtualization. In fact, utilizing VMware virtual infrastructure software with Oracle Solaris 10 for consolidation projects can increase system utilization as much as tenfold. By taking advantage of technology from VMware, enterprises can further capitalize on the high performance, scalability, and energy efficiency of the Sun Fire X4170 M2 and X4270 M2 servers.

Conclusion

The Sun Fire X4170 M2 server is the most versatile IT infrastructure building block system available from Oracle today.

The Sun Fire X4270 M2 servers are the ideal platform for clustered database and virtualized workloads.

To experience the flexibility, density and power of Oracle's Sun Fire X4170 M2 and Sun Fire X4270 M2 servers firsthand, please contact your Oracle account representative.

Sun Fire X4170 M2 and X4270 M2 Server Architecture
January 2011

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Hardware and Software, Engineered to Work Together